

## PROJECT FACT SHEET

**CONTRACT TITLE:** Advanced Reservoir Characterization and Evaluation of CO2-Gravity Drainage in the Naturally Fractured Spraberry Reservoir -- Class III

**ID NUMBER:** DE-FC22-95BC14942

**CONTRACTOR:** Pioneer Natural Resources

**B&R CODE:** AC1010000

**ADDR:** Suite 1400  
5205 N. O'Connor Blvd.  
Irving, TX 75039-3746

**DOE PROJECT MANAGER:**

**CONTRACT PROJECT MANAGER:**

**NAME:** Daniel J. Ferguson  
**LOCATION:** NPTO  
**PHONE:** 918/ 699-2047  
**E-MAIL:** dan.ferguson@npto.doe.gov

**NAME:** William H. Knight  
**PHONE:** 972/ 969-3910  
**FAX:** 972/ 696-3558  
**E-MAIL:** knightw@pioneer-nrc.com

**PROJECT SITE**

**CONTRACT PERFORMANCE PERIOD:**  
7/24/1995 to 7/23/2002

**CITY:** Irving **STATE:** TX  
**CITY:** O'Daniel Field, Midland **STATE:** TX  
**County** **STATE:**  
**CITY:**

**PROGRAM:** Reservoir Life Extension  
**RESEARCH AREA:** Class 3  
**PRODUCT LINE:** ADIS

**CO-PARTICIPANTS:**

**PERFORMER:** Texas A&M University  
**PERFORMER:** EPIC Consulting  
**PERFORMER:** Steve Melzer  
**PERFORMER:**

**CITY:** College Station **STATE:** TX **CD:**  
**CITY:** Calgary **STATE:** **CD:**  
**CITY:** Midland **Can** **CD:**  
**CITY:** **STATE:** TX **CD:**  
**STATE:**

FUNDING (1000'S)	DOE	CONTRACTOR	TOTAL
PRIOR FISCAL YRS	5223	7995	13218
FY 2002 CURRENT OBLIGATIONS	0	0	0
FUTURE FUNDS	0	0	0
TOTAL EST'D FUNDS	5223	7995	13218

**OBJECTIVE:** Determine the technical and economic feasibility of continuous CO2 injection in the naturally fractured reservoirs of the Spraberry Trend.

**PROJECT DESCRIPTION:**

**Background:** At least 15% of all oil remaining in Class 3 (slope-basin and basin clastic) reservoirs may be in the Spraberry Trend. Project participants estimate that currently no less than 6 billion bbl remain in Spraberry reservoirs. The presence of fractures is the dominant influence on performance. Waterflooding was initiated in the Spraberry in the 1950s, but recovery of oil from this process has been relatively poor and only marginally economic. Ultimate recovery under current operations for the Spraberry is extremely low, no greater than 12% of the original oil in place. Prior to this project, no project has evaluated CO<sub>2</sub> injection for enhanced oil recovery in the Spraberry. Because the Spraberry is a fractured reservoir, "conventional wisdom" would imply that recoveries will not be substantially improved. The current project will test the hypotheses that when CO<sub>2</sub> is injected under near-miscible conditions, significant amounts of oil previously unaffected by water injection will be drained by a gravity mechanism from the rock pores into the fractures and moved to producing wells.

**Work to be Performed:** In this project advanced reservoir characterization methodologies will be developed and applied to describe, understand, and model the Spraberry fracture system. Laboratory studies will investigate the potential interaction of the low-permeability rock matrix with the fracture system in the presence of CO<sub>2</sub> to produce oil via a gravity-assisted drainage mechanism. Reservoir modeling studies will assess the technical and economic potential of the proposed approach, and a pilot demonstration will be designed and implemented based on the modeling results. New wells will be drilled, including a horizontal well which will be cored to evaluate reservoir rock and fracture characteristics.

**PROJECT STATUS:**

**Current Work:** Project initiated by Parker and Parsley, who merged with Mesa Petroleum in 1997 to become Pioneer Natural Resources. Project is in Budget Period II. Pioneer Natural Resources office has moved from Midland to Irving, Texas.

**Scheduled Milestones:**

Begin CO <sub>2</sub> injection	02/01
Complete annual report for 2000	03/01
Complete final report	07/02

**Accomplishments:** 1) Reservoir characterizations have been completed. These include matrix description, and pay zone detection (from core integration), fracture characterization and detailed analysis of petrography and diagnosis of the varying rock types of the Spraberry formation. 2) Facilities for the water injection side of the 10-ac. Demonstration pilot project have been constructed. Water injection has been initiated and injection well testing has commenced. 3) All six proposed water injection and three production wells have been drilled. 4) Extensive imbibition experiments clearly indicate that the weakly water-wet behavior of the reservoir rock is responsible for poor waterflood response observed in many Spraberry fields. 5) Wettability index of the Spraberry was found to be approximately 0.2 at reservoir conditions clearly indicating weakly water wet reservoir. 6) Modeling of static and dynamic imbibition experiments show that static imbibition tests do not reproduce the behavior characteristics of dynamic conditions that prevail in the reservoir. 7) CO<sub>2</sub> gravity drainage experiments in Spraberry and Berea whole cores at reservoir conditions continue to validate the premise that CO<sub>2</sub> will recover oil from tight, unconfined Spraberry matrix. (8) In 1999 extensive field testing was conducted using pilot wells. Tests conducted include: step rate injection test, injection profile logging, interference (pulse) test, pressure buildup/falloff. These tests are being used to enhance the reservoir characterization process. (9) Four water injection wells and three producing wells have been drilled. Two production wells have been converted into water injection wells. Water injection began in March 1999. (10) Four gas injection wells were drilled and completed in the 1st quarter 2000. (11) Two logging observation wells were drilled in the second quarter 2000. Remedial cement jobs were performed on these wells 3rd quarter 2000 to ensure good bonding behind pipe in the Upper Spraberry. (12) Chemical tracer was injected into the six water injectors in August 2000. Samples from 29 surrounding wells were gathered and analyzed during 3rd and 4th quarter 2000 to identify well to well interconnectivities. (13) Carbon Dioxide injection into the Pilot area began in 1st Quarter of 2001. (14) Implemented Water Alternating Gas Injection process in 3rd Quarter 2001.

**TECHNOLOGY TRANSFER:**

**Technology/Information Transfer:** 1. Prepared and presented SPE Paper number 7160a, "CO<sub>2</sub> Pilot Design and Water Injection, Performance in the Naturally Fractured Spraberry Trend Area, West Texas" at the 2001 Annual Technical Conference and Exhibit in New Orleans, Louisiana, September 30 through October 3, 2001.

2. Prepared and presented SPE Paper number 71635, "Development of a Fracture Model for Spraberry Field, Texas USA" at the 2001 Annual Technical Conference and Exhibit in New Orleans, Louisiana, September 30 through October 3, 2001.

**Public Relations:**

Updated By: Dan Ferguson

Date: 1/14/2002